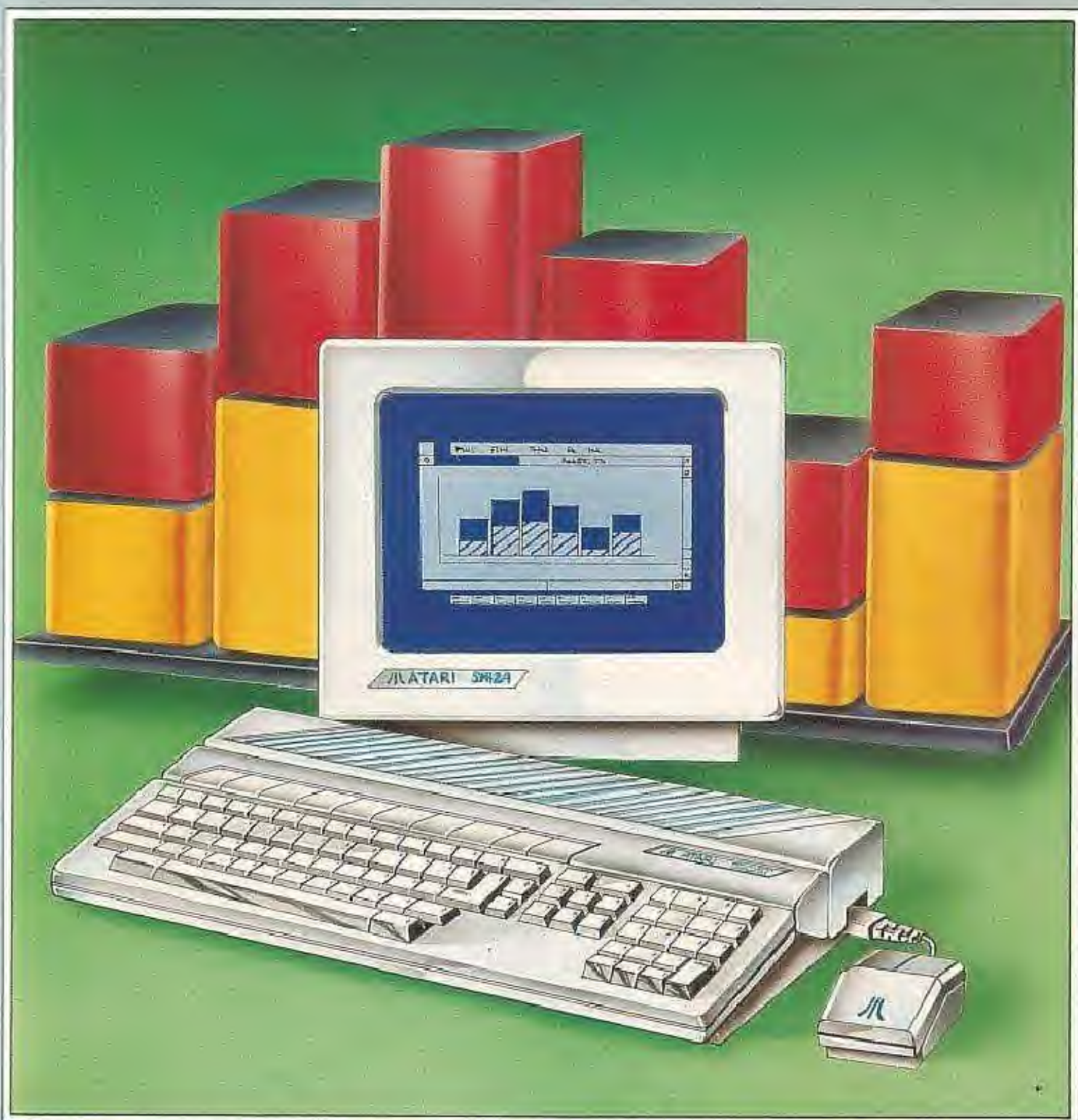


Vol. 1 No. 2

April 1986

Atari ST User



- *A powerful new language for the ST: Modula-2 reviewed*
- *Race is on to produce 'compact disc' sound on the ST*
- *Making the most of GEM: more expert hints and tips*

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A04



Megabyte ST released in UK

MIKE COWLEY reporting

ATARI'S Big One – the one megabyte ST – has finally taken its bow in the UK and so too has its baby brother, the cut price version of the 520ST, the 520STM.

The news of the twin launch was greeted by rival manufacturers with all the enthusiasm of the local hard man finding himself matched against Frank Bruno and Barry McGuigan at one and the same time. For at their respective levels, the 1040ST and the 520STM are likely to prove to be knock out specialists.

Weighing in with one megabyte of memory, the 1040ST appears to be in a class of its own at the moment in the micro heavyweight division. It comes with a built-in one megabyte disc drive, mouse, integrated operating system, internal power supply and choice of either a 12in black and white, high resolution or 14in colour monitor.

And Atari has given it that extra Rambo quality by fixing its price at less than £1,000. "This isn't just going to knock them over it's going to leave them for dead", snarled an Atari spokesman with all the venom of a cigar chewing boxing promoter.

If that wasn't enough, the Jack Tramiel training camp has thrown up at the same time the 520STM, the machine they predict is set to become the people's champion in the 16 bit market.

A stand-alone computer, it is really the unbundled version of the 520ST with built-in operating system, mouse and internal modulator.

Though the price of this little bruiser had still to be fixed as we went to press – the weakness of the dollar forcing last minute revision of calculations – it is expected to flex its muscles in the region of £300.

★ ★ ★

REPORTS from West Germany say that Atari is working on a Unix system and a co-processor unit for the ST series. German news agency CW Communications quotes Atari executives as confirming development of a 32 bit co-processor extension incorporating a 32-bit Motorola chip and having a 2mbyte – expandable to 4mbyte – onboard Ram.

The co-processor unit is expected to make its debut later this year with the Unix version of the ST entering the market in 1987. Informed sources close to Atari have been quoted as



Megabyte ST

saying that the unit will cost between \$500 and \$600.

★ ★ ★

TWO new software packages for the 520 ST have been announced by Quest International Computers. The Philon Fast Basic-M and Compiler offers programmers the facility to port existing applications to the Atari, Basic-M being



Cash Trader

compatible with Mbasic. It costs £99.95.

For the business user Quest has ported its Cash Trader program to the ST. Priced £99.95, the software offers windows for entering, reporting and help screens.

★ ★ ★

WORLDWIDE distribution of Atari ST software has been undertaken by Activision, who intend using their vast network to markedly increase the company's base. Versions of two of their titles, Hacker and Mindshadow will shortly be out for the ST.



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THIS month I've selected three routines from the other half of the ST's Gem operating system, following our look at the ST's built-in virtual device interface routines in last month's column.

Unfortunately the applications environment services (AES) is mainly concerned with the ST's window and menu capabilities. Basic is far too slow to cope with their control.

Perhaps when a Basic compiler comes on to the market I will take another look at the AES routines and see which are usable from Basic using the compiler.

To access the ST's AES you must use the GEMSYS(X) command, which is sparsely described on page C-57 of the ST's Basic manual. You must replace the X in the brackets – the parameter – with the routine's op-code.

The first routine that I have chosen from the AES manual allows you to change the shape of

```
10 FULLW 2 : CLEARW 2
15 Z=0
20 FOR A=0 TO 72
30 GOTOXY A,Z:?"X"
40 NEXT A
50 Z=Z+1:IF Z=18 THEN END
60 GOTO 20
```

Program IV

```
10 FULLW 2 : CLEARW 2
15 Z=0
20 FOR A=72 TO 0 STEP -1
30 GOTOXY A,Z
35 ?TAB(A)"X"
40 NEXT A
50 Z=Z+1:IF Z=18 THEN END
60 GOTO 20
```

Program V

the mouse from within your programs. The op-code for this routine is 78 and you must poke the required shape (see Figure 1) into GINTIN. There are eight shapes available including the busy bee and various types of cross hair. The demonstration program, Program I, shows exactly how it's done.

Program II lets you pause the program while waiting for any key to be pressed. The op-code is 20 and the demo program should give you all the details that you need.

The last of this month's routines, Program III, will pause the program for a set number of milliseconds, up to a maximum of 60 seconds. Its op-code is 24 and you must poke the number of milliseconds into GINTIN before calling the routine. The third demonstration program pauses for 10 seconds.

Problems, problems

The first comes from A. Kassell of Plymouth who is having problems with his copy of Doodle.

When you select the Save option to save a screen to disc, Doodle requests that you type in a filename. This filename must be entered in upper-case – use either shift or shift-lock – and must end with .DOO, so that Doodle can load it at a later date. If this doesn't work you probably have a bad copy and should return it to the shop for replacement.

David Thomson of Paisley is having problems finding an RS232C lead for his Brother HR5 printer, and N. Judge from Ashford finds it difficult to connect his Granada RGB monitor/TV to his ST. Leads for both of these can be had from Silica Shop (01-309 1111). The monitor cable is order number STA6700 and the printer lead is number STA7700. Each costs £19.95. Make sure that Silica Shop will allow you to return

```
10 REM ----- CHANGE MOUSE SHAPE -----
20 AC=0
30 CONTROL=PEEK (AC)
40 GLOBAL=PEEK (AC+4)
50 GINTIN=PEEK (AC+8)
60 GINTOUT=PEEK (AC+12)
70 ADDRIN=PEEK (AC+16)
80 ADDROUT=PEEK (AC+20)
90 FOR SHAPE = 0 TO 7
100 PEEK GINTIN, SHAPE : REM POKE IN MOUSE SHAPE
110 GEMSYS (78)
120 FOR DELAY = 0 TO 1000 : NEXT DELAY
130 NEXT SHAPE
140 POKE GINTIN, 0
150 GEMSYS (79) : REM RETURN MOUSE TO NORMAL
```

Program I

```
10 REM ----- WAIT FOR THE KEYBOARD -----
20 AC=0
30 CONTROL=PEEK (AC)
40 GLOBAL=PEEK (AC+4)
50 GINTIN=PEEK (AC+8)
60 GINTOUT=PEEK (AC+12)
70 ADDRIN=PEEK (AC+16)
80 ADDROUT=PEEK (AC+20)
90 GEMSYS (20)
100 PRINT "YOU PRESSED A KEY!"
```

Program II

```
100 REM ----- WAIT FOR MILLISECONDS -----
110 AC=0
120 GINTIN=PEEK (AC)
130 GLOBAL=PEEK (AC+4)
140 GINTIN=PEEK (AC+8)
150 GINTOUT=PEEK (AC+12)
160 ADDRIN=PEEK (AC+16)
170 ADDROUT=PEEK (AC+20)
180 SEC = 10
190 SEC = SEC*1000
200 POKE GINTIN, SEC
210 GEMSYS (24)
```

Program III

Number	0	1	2	3	4	5	6	7	256	257
Cursor	Arrow	Text cursor	Busy bee	Hand with pointing finger	Hand with extended fingers	Thin cross-hair	Thick cross-hair	Outline cross-hair	Mouse off	Mouse on

Figure 1: Available mouse cursor shapes.

these general purpose cables if they don't work with your particular set-up.

Richard Chalcraft of Worthing has discovered a bug in the ST's Basic. The problem lies in Basic's GOTOXY command. Program IV illustrates the problem perfectly. The Xs generated by the program are supposed to be next to each other. The problem is that GOTOXY doesn't use the correct X coordinate. This makes positioning difficult.

The only solution that I have been able to find is using the TAB function instead of the X coordinate. The main problem with this method is that TAB writes over characters to the left of the cursor, with spaces. Therefore you have to place characters on the screen from right to left. Program V shows this solution.

Several of you have complained of the lack of software for the ST. This is a perennial problem. When new machines become available they invariably have little or no software.

At this stage, the only people who should buy them are computer freaks like myself who can have fun using a computer without necessarily being able to do any useful work with it.

Often, however, people who want to do some work with their machine are pulled in by the hype and buy a machine that has very little software actually on the shop shelves.

The 520ST — and the Apple Macintosh before it — suffered heavily from this. The ST might be one of the easiest computers to use, with its mouse, menus and windows, but it's difficult to get to grips with it from a programmer's point of view.

This means that the first few programs that have appeared have not used the Gem interface and have looked like they were running on a keyboard based IBM rather than a mouse based ST. It has taken several months for the software companies to come to terms with the ST.

Hopefully by the time you read this, good quality software will begin to appear in quantity. Programs such as Batteries Included's DEGAS show what can be done. If your enthusiasm for your ST has waned during the last few months now is the time to restoke your fires and come out fighting armed with your ST.

With the announcement from Atari of new ST machines on the way Mr Kowal of Melton Mowbray is wondering whether or not to wait before buying an ST.

Last month in *Atari ST User* we told you that Atari has announced a 1mbyte version of the ST (1040ST) for \$1,000 B&W or \$1,200 for colour and a TV modulator version of the 520ST for about \$400. The current ST package sells in the States for \$800 B&W and \$1,000 colour. This

means that the 1040ST is likely to cost £850 B&W and about £1,050 colour and the modulator 520ST will probably cost around £350 (without a much needed disc drive).

I don't think the basic modulator version will ever arrive in the UK, but the 520ST FM is much more likely with its built-in drive. The 520ST FM will probably cost around £450. The present 520ST will probably drop in price to around £600 for B&W.

Should you buy now or wait? First ask yourself

HINTS

- The file selection section of most ST programs is easy to use. You simply point at the file that you want and then click on OK. The only problem arises when your file is on a different disc from the program.

To read in the directory of another disc is quite easy. After the file selection box comes up on the screen change the disc in the drive and then click once on the top of the small window which contains the file listing. The new disc's directory will now be read in.

You must always use this method when changing discs as changing discs without rereading the directory might lead to your discs being corrupted and unusable.

- The latest batch of free software from Atari comes on three discs. If you take a careful look at them you will notice that Megaroids, Doodle and DBMaster could easily fit on to one disc. If you move Megaroids and Doodle on to the DBMaster disc you can then erase the Megaroids/Doodle disc, and Atari has supplied you with a free blank disc.

- If you are having problems with STWriter I recommend that you transfer to the new Atari word processor FirstWord. It's far easier to use and can also be used to edit Basic and C programs.

whether or not you need 1mbyte of memory. The newer 520STs will have Gem in ROM and therefore have about 450k for programs. Only software developers and large businesses will need 1mbyte of memory.

My advice is to wait until the new machines arrive, remembering that the 520STM is probably a non-starter, and then buy the machine that you think most suits your needs.

You'll be able to add a monitor to the modulator STs if you should wish to. The B&W monitor costs around £150 and the colour around £400. If you should wish to upgrade to 1mbyte at a later date several companies are about to offer upgrades for the 520ST for about £150.

- That's it for now. Next month I'll be answering your problems and detailing my adventures at the Atari User Show. In the meantime I'd like to hear your opinions on the new ST machines.





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Modula-2 for compact code

A GOOD computer needs good languages to utilise all of its capabilities. The Atari 520 ST is one of the newest and best computers on the market today. Now TDI, a British software company, has released Modula-2 for the ST, and it is a fine example of what a good language should be.

First let me explain what Modula-2 is for those that have not heard of it yet. Niklaus Wirth, the inventor of Pascal, also invented Modula-2. The language is an addition to Pascal and has these five added features:

- The module concept, and in particular the facility to split a module into a definition part and an implementation part.
- A more systematic syntax which facilitates the learning process. In particular, every structure starting with a keyword also ends with a keyword, so is properly bracketed.
- The concept of process as the key to multi-programming facilities.
- So called low-level facilities which make it possible to breach the rigid type consistency rules and allow you to map data with Modula-2 structure onto a store with inherent structure.
- The procedure type which allows procedures to be dynamically assigned to variables.

TDI's Modula-2 compiler implements the full Modula-2 language as described by Wirth. It includes separate compilation, opaque types, co-routines (pseudo-concurrent processes) and floating point routines. It is integrated into the Gem environment and will support all the Gem routines. It also promises to make compact code.

As in all high-level languages the Modula-2 package comes in three parts — an editor, a compiler and a linker in a two-disc package. There is no copy protection on any of the discs and you can arrange the system to fit your convenience. A good demonstration of the power of Modula-2 is included. Since most programmers do not spend much time with either the compiler or the linker, the editor is the most important part of the package. This one is very user friendly and powerful.

The full screen editor uses both the mouse and

the function keys. You can point the mouse to the spot where you want to work and click it. This will be the new spot where writing begins. Using the function keys you can move one word right or left, page up and down, and move a line up and down.

The arrow keys are also used to move around the screen. The deletion function works similarly as the movement functions with the ability to delete character right or left, word right or left, or line right or left. You can undo with the Undo.

For large insertions or deletions, you can Mark and Cut or Paste text into the proper spot. These abilities are usable both with the mouse and drop down menus, as well as using the function keys.

One more function is unique to this editor. After a program is written it is compiled. Most of the time there are errors in the compilation, and with this compiler the errors are written to a file on the disc. When you return to the editor the error file and your original file are combined so that there are little @s where the errors occurred.

All the errors in the program are examined. There is even a special function key for looking for the next @. When the cursor is moved to this spot a message will be shown at the bottom of the screen with the error number. The error number can then be looked up in the table in the Modula-2 book.

There are four pages of possible errors, and they are well defined so it is easy to correct them and continue. This listing of the error messages in a file that is merged into your file shows the time and effort that went into making this fine package. The editor was, of course, written in Modula-2.

Figure 1 shows a sample program in Modula-2 and you can see the various differences between it and Pascal. Firstly, there are two parts to the program, a definition module and an implementation module. There is a difference between what a procedure does and what the outside world sees of the program. You must define what will come out of the module,

**Sol Guber
reviews
a high level
language
for a high
tech micro**


```

DEFINITION MODULE RandomNumbers ;

(*-----*)
(* 1985 Copyright 1985 102 Ltd. All Rights Reserved *)
(*-----*)

EXPORT Random ;

PROCEDURE Random (MaxValue : LONGCARD) : CARDINAL ;
END RandomNumbers ;

IMPLEMENTATION MODULE RandomNumbers ;

CONST
  M = 1000000 ;
  a1 = 12495 ;
  D = 314159265 ;

VAR seed : LONGCARD ;

PROCEDURE Random (MaxValue : LONGCARD) : CARDINAL ;

  PROCEDURE Multiply ;
    VAR p0, q0, m1, n1 : LONGCARD ;

    BEGIN
      p1 := p DIV a1 ;
      p0 := p MOD a1 ;
      q1 := q DIV m1 ;
      q0 := q MOD m1 ;
      RETURN ((p0*q1 + p1 * q0) MOD m1) * m1 + p0*q0 MOD M ;
    END Multiply ;

BEGIN
  seed := (Multiply (seed,D) + 1) MOD M ;
  RETURN CARDINAL ((seed DIV a1) * MaxValue) DIV m1 ;
END Random ;

BEGIN !! MODULE !!
  seed := 34982 ;
END RandomNumbers ;

```

Figure 1: Modula-2 sample program

and in this case a CARDINAL number will be EXPORTed from the module.

A second difference is in the fourth from last line. The language uses very strong typing. To return a CARDINAL number from a function that uses a division between LONGCARDS you must specify that the CARDINAL number is returned. All procedures and parameters must be typed so that the program will know what type of variable it is.

There are several subtle points in the example module shown in Figure 1. One not seen is what can be done with this module. First, it can be compiled and when needed by any other program it can be IMPORTed into that program. Modula-2, unlike Pascal, can link together compiled code using the linker. This means that a library can be put together and used just like any other function.

A second point is the interface between parts of the programs. The Definition module explains exactly what another part of the program will see

of the implementation module. The only thing seen by the outside environment is the procedure Random, since it is the only thing that is EXPORTed out.

Variables, variable types, and other procedures can also be EXPORTed out. Objects declared in other modules can be referenced in module M if they are explicitly made to be known in M. They are IMPORTed into M.

The major strength of Modula-2 is that many parts of the program are hidden from other parts. It makes it easy to write and debug parts of programs since you know exactly how they will fit together, as this has to be specified in the definition portion of the module. Also the fine details of a system do not need to be known at any higher level.

The same program can be written for two different machines and each machine will have specific I/O that will be IMPORTed when needed. In terms of I/O you may just wish to have them available, but do not need to know – or rather do not wish to bother to learn – how this works in detail. In many cases you may even wish to hide parts away from access to guarantee that they will work correctly.

There are several extensions to Modula-2 proposed by Wirth. They include a change in the CASE syntax, a new variable type called String, and two new variables for 32 bit machines called LONGCARD and LONGINT. There is optimisation for Boolean constants. The Set type is supported by several new features. Also, you are allowed to have open array parameters.

The most exciting part of the language is the combination of high level and low level implementation. For the low level portion there is a procedure CODE which allows for the insertion of machine language into the object code. There is SETREG to put values into one of the 88000 processor's registers as well as REGISTER to return values.

On the high level end there is the TYPE PROCESS as well as procedure NEWPROCESS. There is IOTRANSFER to move to different peripheral devices as needed and procedure LISTEN for the interrupts servicing. The NEW PROCESS is used to produce concurrent programming.

In all the time I've been using this language I have found no bugs at all. There are some typos in the documentation, but none of these are significant. I have typed in several of the programs from Wirth's book "Programming in Modula-2" and they have worked perfectly.

The major weakness of the package is in the documentation of the Gem routines in the manual. It is expected that the Gem manuals be purchased and read. Without them many of the Gem routines can not be used properly.

Except for this one flaw I have no qualms recommending this language to anyone. It is a good way to move away from DRI's C.



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The programme has a complete implementation of XModem file transfer protocol including block checking and supports all the baud rates including 1200/75 and 75/1200 bps. Bootsectors up to a full disk may be uploaded or downloaded as opposed to files.

A comprehensive set of macros is available. Macros can be defined or altered in the Macro Edit screen and saved or loaded from disk. Any one of ten macros may be sent at any time in Terminal mode by a single keystroke. Macros can be up to 64 characters long and may be chained to give one macro of up to 640 characters. The screen colours and text intensity are alterable and should you not like our default values, you may change the values e.g. baud rate, parity, translation mode, colours etc. and save to a configuration file. At the next power-up your new default values will be installed. Configuration file also saves the ten macros in use at that time.

It is possible to invoke a split screen off line editing screen with independent scrolling. The programme also supports variable margins, delay rates, reconfiguration of your printer for graphics dumps and full error messages in decimal. The menu screen "windows" all present parameters.

Every terminal screen shows the translation type, condition of Memstore (capture) buffer, a resettable real time clock, number of bytes left in the buffer and the resettable elapse time. All these values are shown independent of the scrolling ability of the screen. You may review any data in memory or any file from disk at any time.

The available buffer is 17,000 bytes (compare this with other programmes) and the programme supports the RAM disk of the 130XE allowing an effective increase in the buffer size of 64K for the XE. File transfers longer than memory are possible as well as protection of data in the Memstore buffer during file transfers. Forced breaks may be sent at any time in terminal mode and terminal screens are not cleared when moving to and from the menu screen.

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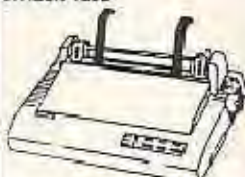
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Midi message from the hills of Wales

Finding Midi software for the 520 is like looking for an atheist in a monastery. Having been foiled numerous times by as many sources I turned despairingly to a vague contact in the remote Welsh hills by the name of Adrian Wagner.

It turned out to be a scoop. Adrian is developing something that will shake up the electronic music business from top to bottom — he is using the 520ST as the brains of a 16 bit resolution sampling system.

We looked at sampling in last month's *Atari ST User*. A sound is recorded through a microphone and stored digitally in the computer's memory. Depending on the software, the sound can then be edited, using graphics, sent back to an instrument — usually a keyboard — and played back at any pitch.

A range of samplers use popular 8 bit micros. The Rolls Royces of sampling, however, are the Sinclair and Fairlight, costing £55,000 and £35,000. They use 16 bit processors, which greatly increase the sound quality. An 8 bit system can only sample 256 levels of dynamic change. A 16 bit processor can sample over 65,000 characteristics of a sound.

Adrian Wagner's system will use the full 16 bit capability of the 520ST to produce a sampler comparable to the Fairlight and Sinclair — and cost less than the present 8 bit packages. According to Adrian, the sampling frequency to scanning rate is the same as that of a Philips Compact Disc. This means the quality of sound recording will be superb.

The software will allow the sound to be displayed and edited on the screen. The wave form of the sampled sound will be displayed, ready to be edited with the mouse. For example you could record a thunderclap and decide you didn't like the high edge. Altering the wave shape on the screen will alter the sound played. There will be facilities to loop a note, to make it longer, delay, reverberate and echo sounds. You will also be able to record a sound and play it backwards.

Adrian complained about the ST's operating system. "It's full of bugs. Some of them make it difficult to talk to the ports. When it finds an error 100,000 roadstools appear on the screen". The operating system was probably written by an old hippy high on magic mushrooms.

My enthusiasm restored I made a final

attempt to get in touch with Island Logic which had claimed the previous week it no longer existed. This time I was told it had now been reorganised and was busy preparing music software for the 520ST.

Island's package is due "sometime this year". It is based on Island's Music System for the BBC Micro and Commodore 64, but will use the ST's 16 bit muscle to produce a much higher quality sound. Pull down menus and graphics environment will make the software easier to use.

The Music System will feature a keyboard



The quality of sound recording will be superb

emulator which allows you to use the 520's keyboard as a substitute for a musical keyboard. You play on qwerty instead of Steinway. Notes will appear as you play them on staves on the screen. The system will record your notes in real time, whether played on the ST keyboard or a Midi connected instrument.

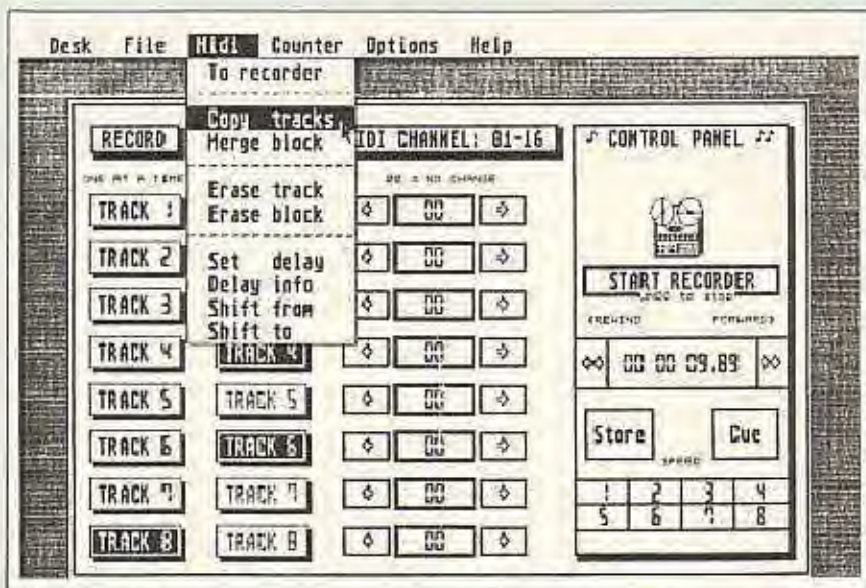
There are six parts to the program, including the keyboard emulator and instrument connector modules. An on-screen editor will display and record notes as they are played. You can then edit the final score using the mouse. Notes will be picked up and dropped on the chosen line. Music will be manipulated and edited in the way text is edited by a word processor program.

One of the Music System's most exciting features will be the synthesiser module. It will display a sound's characteristics graphically and allow the voice to be altered on screen by editing the ADSR graph and wave shape. The system will include a library of pre-defined voices which can be edited in the same way.

Music System will also contain a mixing desk. This will enable tracks to be mixed, linked, and edited between different voices. Island's Adrian Boot said there will be the potential to mix an almost infinite number of tracks. The only limitation will be the output system.

The system will connect to a printer. This will

Anthony Ginn hunts for Midi software for the 520, — and finds there's not a lot of it about



enable musical scores to be dumped onto paper. It will also feature a simple word processor to add and edit lyrics with the score. Music System's modules will communicate with each other. A voice created on the synthesiser can be played on the keyboard emulator; or an external Midi instrument, the score recorded and edited on screen, lyrics added, and the final score dumped onto paper.

Music System sounds like it will be a comprehensive low priced package, ideal for the beginner. As soon as it's available we'll do a proper review. Apparently Activision is releasing a similar package for the ST in America called Music Studio, so Island had better get their Midis out before the competition arrives.

Soon after these discoveries the Editor told me he had just got a 520 Midi music package from Holland. The Dutch disc is a Midi recorder package. It arrived on Friday, but I had to get married, it needs a megabyte of memory, my car broke down, Casio still haven't sent me C101

options – to recorder, copy tracks, merge block, erase track, erase block, set delay, delay info, shift from and shift to.

To recorder puts the ST into the recording mode. A new menu, recorder, lets you decide which tracks to record on. Clicking the right mouse button will start recording. Undo stops recording and the recorded track will appear under the header Play.

It wasn't clear from the documentation whether the program will record 8 or 16 tracks. The block of tracks (master tape) can be rewound or moved on by holding the mouse button down when the pointer is over the rewind or fast forward icon. Eight tracks are displayed simultaneously on the screen. Each has fast forward and rewind icons, and a digital counter to show where you are on the tape. The software turns the 520 into a digital recorder. Portraying the functions in tape recorder language makes it easy to understand digital recording and mixing. The package seems exciting and will be reviewed as soon as possible.

It looks like two types of music software will appear over the next few months. Packages like Island's Music System and Activision's Music Studio will be for the home user interested in making music. They will be inexpensive and do a bit of everything – recording, graphic editing of voices and scores, keyboard emulation and simple mixing.

More specialised systems, like the Dutch recorder and Welsh sampler, will appear for professional musicians. They will use the full power of the micro to perform a specialised job. Many professional musicians and sound engineers will use the 520 as a dedicated digital music system. Atari ST User will keep you up to date with developments.



**You play on
querty instead
of Steinway**

Midi synth, I ran out of time, I had a headache and we had a power cut, so I haven't been able to play around with it yet.

The preliminary documentation indicates that it works like a conventional multi-track recorder with extra options. There are five pull down menus. One is entitled Midi and contains the



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This superb package turns the ST into an easy-to-use and configure terminal. Operating under the GEM environment, all the normal parameters can be changed very easily and subsequently saved permanently. Its impressive features include:

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The ATARI ST Explored

by John Draga

£ 8.95 no VAT

This comprehensive guide to the Atari ST gives potential purchasers of the ST an invaluable guide to the capabilities of the ST and will give owners guidance to enable them to get the most from this remarkable system.

Topics covered include GEM, TOS, the BIOS, ST Basic and LOGO with an in-depth coverage of 68000 assembly code giving useful information including details on system variables and operating system calls to the BIOS. There are also sections on how to configure the keyboard and utilise the Serial interface to connect the ST to printers, electronic mail services and other computers.

The text is liberally illustrated with diagrams and examples, making it easy to follow and understand, this book is essential to anyone using, or considering using, an Atari ST.

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